Customer Satisfaction Measurement with Dummy Variable Regression with Constraints

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Abstract: *A new method for measuring and analyzing customer satisfaction is presented in this paper. The mathematical model expresses the fundamental relationship between criteria and the overall utility which expresses the global customer satisfaction. The procedure used to estimate the basic model is dummy variable regression with constraints. The method can very simply consider nonmetric data by codification of the criteria levels so in that way is possible to consider the qualitative judgments and preferences of the customer. The method accounts for the non-linear response of customer satisfaction to the performance of different product/service criteria. The paper presents the interpretation of the results based on the utility functions for each criterion. The main advantages of the method are discussed and future research about this topic is proposed.*

Keywords: customer satisfaction, dummy regression analysis, multicriteria analysis

1. Introduction

Achieving customer satisfaction is the primary goal of most firms today. Quality and customer satisfaction are commonly recognized as pivotal determinants of long-term business success (Bussaca *et al*, 2005). A broad definition of customer satisfaction is that it is an emotional response to the use of a product or service and it is also a complex human process, which involves cognitive and affective processes, as well as other psychological and physiologic influences (Oh and Parks, 1997; Oliver, 1981). The interest in measuring customer satisfaction is reflected in its ability to help build up customer loyalty (Cronin and Taylor, 1992), enhance favorable word of mouth (Halstead and Page, 1992), lead to repeat purchases (Fornell, 1992) and improve the company's market share and profitability (Oh and Parks, 1997).There are two broad types of scale that have been used to measure customer satisfaction. These two broad types are single-item scales and multi-item scales. Many

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researchers have used simple single-item scales to globally reflect the client's preferences and expectations concerning a product or a service. The scale reflects "very satisfied" to "very dissatisfied" responses (Andreasen and Best, 1977; Oliver, 1977; Olshavsky and Miller, 1972, Westbrook, 1980). The problem of the single-item scale is that it cannot provide information on the criteria and cannot assess the various dimensions of customer satisfaction separately; therefore it may not capture the complexity of customer satisfaction entirely. The multi-item scales overcome this problem because here the survey respondents are not just asked to give an overall evaluation of their satisfaction with the product or service being evaluated but they are also asked to evaluate the key criteria of the service process or product (Danaher and Haddrell, 1996).

In the next section it will be introduced a model that uses multi-item scales to measure client satisfaction. The model will permit the evaluation of customer's satisfaction level globally and also on the various key criteria of the provided service or product. Following this it will be presented a hypothetical customer satisfaction survey where the criteria will be outlined. The results of the study will be reported and conclusions will be reported as well as future research in this topic.

Methodological Review

According to Oh et al (2004), researchers most frequently used descriptive data analysis methods including, for example, content analysis, correlation, t-test, frequency and cross-tabulation, and importance-performance analysis. Multivariate techniques such as factor, cluster, and discriminant analysis showed high usage rates, especially coupled with the methods of the analysis of variance in the market segmentation studies. Causal modeling using regression, logit, and structural equation analyses shared strong popularity, when compared to techniques such as time series, conjoint analysis, and artificial neural networks. Used in much lesser frequency were special analysis methods like the analytical hierarchical process and data envelopment analysis. Also belonging to multicriteria analysis methods are some variants of the utility additive (UTA) multicriteria method which have also been used in measuring customer satisfaction. One example is the MUSA method consisting in a preference disaggregation methodology which follows the principles of ordinal regression analysis under constraints using linear programming techniques (Jacquet-Lagrèze et al, 1982; Siskos et al, 1985; Grigoroudis, 2002).

2. The basic model

Data analysis techniques, as conjoint analysis are usually applied in measuring customer satisfaction. Conjoint analysis is a survey based method for measuring customer's trade-offs among product and service criteria (Malhotra, 2004). In formulating the conjoint analysis problem, the researcher must identify the criteria and criteria levels to construct the stimuli to be used in a conjoint evaluation task. Criteria levels denote the values assumed by the criteria or salient attributes, because from a theoretical standpoint the criteria selected should be salient in influencing the customer preference and choice. Once the criteria have been identified, their appropriate levels determine the number of parameters that will be estimated and also influences the number of stimuli that will be evaluated by the respondents. The utility or part-worth function for the levels of a criterion may be nonlinear. The part-worth functions or utility functions describe the utility that consumers attach to the levels of each criterion. For example a consumer may prefer a medium-sized car to either a small or large one. Likewise, the utility for price may be nonlinear. The loss of utility in going from a low to a medium price may be much smaller than the loss in utility in going from a medium to high price, (Malhotra, 2004). According to conjoint analysis methodology, respondents are shown profiles of product or service offering, which are made up of a set of attribute levels. Each respondent receives a set of profiles and evaluates each profile's "worth" to him/her on some type of preference or likelihood-of-purchase scale.

The objective of this paper is to present a method derived from the approach of conjoint analysis that can be used to measure the overall customer satisfaction with a product or a service. The problem of measuring customer satisfaction can be perceived as a multicriteria evaluation problem assuming that customer's global satisfaction depends on a set of customer's criteria or salient criteria.

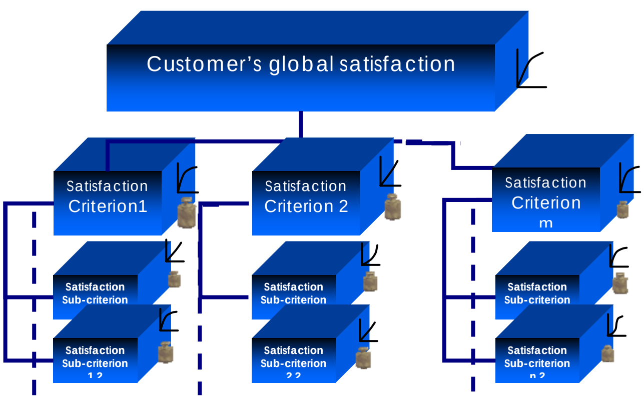

Fig.1 – Hierarchical structure of the several customer satisfaction dimensions

Model development

The main objective of the proposed model is to aggregate the individual customer satisfaction dimensions, or criteria into an overall utility function or global customer satisfaction function. The mathematical model expressing the fundamental relationship between criteria and overall utility may be represented by the formula:

$$U(X) = \sum_{i=1}^{m} \sum_{j=1}^{k_i} \alpha_{ij} x_{ij} \qquad 1.$$

Where:

U(X) = Overall utility or global customer satisfaction

α_{ij}= The part-worth contribution or utility associated with the j^{th} level (j, j=1, 2, …, k_i) of the i^{th} criterion (i, i=1,2, …, m)

k_i= number of levels of criterion i

m= number of criteria

x_{ij} = 1 if the j^{th} level of the i^{th} criteria is present

x_{ij}=0 otherwise

The importance of a criterion I_i is defined in terms of the range of the utilities α_{ij} across the levels of that criterion:

$$I_i = \{\max(\alpha_{ij}) - \min(\alpha_{ij})\} \qquad 2.$$

The criteria's importance is normalized to ascertain its importance relative to other criteria,

$$W_i = \frac{I_i}{\sum_{i=1}^{m} I_i} \qquad 3.$$

so that the sum of all relative importance's equal to the unity:

$$\sum_{i=1}^{m} W_i = 1 \qquad 4.$$

One of the procedures that can be used to estimate the basic model is dummy variable regression. The dummy variable regression uses a set of dichotomous variables known as dummy variables also called binary, instrumental or qualitative variables. The dummy variable regression is appropriate when the independent variables are non metric with two or more levels. It can very simply consider nonmetric data by codification of the criteria levels. In that way is possible to consider the qualitative judgments and preferences of the customer according to each criterion, and also the expressed global satisfaction of the customer in relation to the product or service being evaluated.

$$\sum_{i=1}^{m}\sum_{j=1}^{k_i}\alpha_{ij}x_{ij}-U(X)=0 \qquad 5.$$

$$\sum_{i=1}^{m}\sum_{j=1}^{k_i}\alpha_{ij}x_{ij}-\sum_{l=1}^{n}\gamma_l y_l=0 \qquad 6.$$

l = number of global satisfaction levels

γ_l = The part-worth contribution or utility associated with the l^{th} level (l, l=1, 2, …, n) of the global satisfaction.

Let's consider m criteria, each criterion with k_i levels, and the global satisfaction scale with l levels.

The model estimated can be represented as:

$$\sum_{i=1}^{m}\sum_{j=1}^{k_i-1}a_{ij}X_{ij}-\sum_{l=1}^{n-1}g_l Y_l=0 \qquad 7.$$

X_{ij} = Dummy variable associated with the j^{th} level (j, j=1, 2, …, k_i) of the i^{th} criterion (i, i=1,2, …, m)

Y_l = Dummy variable associated with l level of the ordinal global satisfaction scale.

a_{ij} = model parameter associated with the j^{th} level (j, j=1,2, …, k_i) of the i^{th} criterion (i, i=1,2, …, m)

g_l = model parameter associated with l level of the ordinal global satisfaction scale.

A dummy variable of the type X_{ij} represents a level of a criterion from an ordinal scale. Any k-point ordinal scale will have k levels which can be represented by (k-1) dummy variables.

For criterion i, the levels will be coded as follows:

Criterion i	X_{i1}	X_{i2}	…	$X_{i(k_i-1)}$
Level 1	1	0	0	0
Level 2	0	1	0	0
…	…	…	…	…
Level k_i-1	0	0	0	1
Level k_i	0	0	0	0

A dummy variable of the type Y_l represents a level of the ordinal global satisfaction scale. Any l-point ordinal scale will have l levels which can be represented by (l-1) dummy variables.

Global	Y_1	Y_2	…	Y_{l-1}
Level 1	1	0	0	0
Level 2	0	1	0	0
…	…	…	…	…
Level l-1	0	0	0	1
Level l	0	0	0	0

The codification was performed considering the last level as the base level. Nevertheless to make the codification it will be irrelevant the level chosen to be the base level.

To estimate the parameters of the model it is necessary to consider some constraints due to the ordinal nature of the satisfaction scale used for all the criteria as well as for the global satisfaction scale. The monotonicity constraints depend in the way that the codification was made. With the last level chosen to base level the constraints are:

$$a_{ij} \le a_{i(j+1)} \qquad \forall\ i, \text{ with } j=1, 2, \ldots, k_i-1 \tag{8.}$$

$$a_{i(k_i-1)} \le 0 \qquad \forall\ i \tag{9.}$$

It is necessary to consider an additional constraint to avoid the solution where all parameters equal to zero which is a possible solution but not a realistic one.

$$\sum_{i=1}^{m} a_{i1} = \text{constant}, (\neq 0) \tag{10.}$$

The same procedure is necessary for g_l:

$$g_l \le g_{l+1} \qquad \text{with } l=1, 2, \ldots, n-1 \tag{11.}$$

$$g_1 = \text{constant}, (\neq 0) \tag{12.}$$

The model follows the principles of regression with Dummy variables with some constraints due to the monotonicity assuming the ordinal nature of the scales used. To run the regression it will be considered a constrained linear least-squares approach.

Running the regression is possible to estimate the parameters of the model. The coefficients may be related to the part-worths or utilities because each dummy variable coefficient represents the difference in the utility of that level minus the utility of the base level.

So we have:

$$\alpha_{ij} - \alpha_{ik_i} = a_{ij} \qquad \forall\ i, \text{ with } j=1, 2, \ldots, k_i-1 \tag{13.}$$

$$\gamma_l - \gamma_n = g_l \qquad \text{with } l=1, 2, \ldots, n-1 \tag{14.}$$

To solve for the utilities, it is necessary to impose an additional constraint for each criterion and also for the global satisfaction. The utilities are estimated on an interval scale, so the origin is arbitrary. Therefore we can consider an additional constraint where the sum of the utilities of each criterion must be equal to a constant, as well as for the global satisfaction:

$$\sum_{j=1}^{k_i-1} \alpha_{ij} = \text{constant} \qquad 15.$$

$$\sum_{l=1}^{n} \gamma_l = \text{constant} \qquad 16.$$

Solving the equations is possible to obtain the utilities for all the criteria and also the utilities for the global satisfaction.

The normalization of the utilities may be represented by the following formulas:

$$\alpha_{ij}^{*} = \frac{\alpha_{ij} - \alpha_{i1}}{\alpha_{ik_i} - \alpha_{i1}} \times 100 \qquad \forall\, i, \text{ with } j=1, 2, \ldots, k_i \qquad 17.$$

$$\gamma_l^{*} = \frac{\gamma_l - \gamma_1}{\gamma_n - \gamma_1} \times 100 \qquad \text{with } l=1, 2, \ldots, n \qquad 18.$$

Interpretation of the results

After the estimation of the utilities is possible to calculate the relative importance weights of each criterion. The estimated weights indicate which criteria are important in influencing customer satisfaction. The estimation of the utilities and the relative importance weights provides a basis for interpreting the results. For interpreting the results is helpful to plot the utility functions. The estimated utility functions are very important because they show the utility that the customers give to each level of the global satisfaction scale, as well as for the levels of the ordinal scales of each criterion.

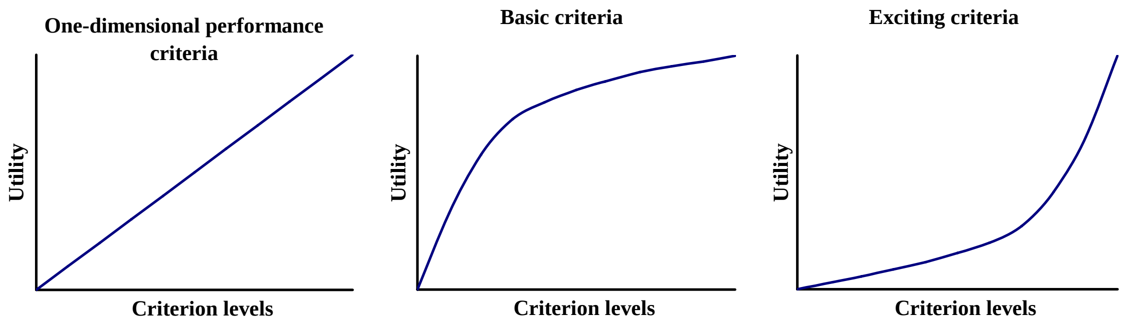

Fig. 2 - Utility function according to the category of the criterion.

By analyzing the utility functions plot is possible to see which criteria have a more than proportional influence on satisfaction, and which criteria are an absolute must in the eyes of the customer. According to Kano's model of customer satisfaction (Kano, 1984) we can distinguish between three types of product requirements which influence customer satisfaction in different ways:

Must-be requirements: If these requirements are not fulfilled, the customer will be extremely dissatisfied. On the other hand, as the customer takes these requirements for granted, their fulfillment will not increase his satisfaction. The must-be requirements are basic criteria of a product or service. The customer regards the must-be requirements as prerequisites, he takes them for granted and therefore does not explicitly demand them. Must-be requirements are in any case a decisive competitive factor, and if they are not fulfilled, the customer will not be interested in the product or service at all.

One-dimensional requirements: With regard to these requirements, customer satisfaction is proportional to the level of fulfillment. The higher the level of fulfillment, the higher the customer's satisfaction and vice versa. One-dimensional performance criteria are usually explicitly demanded by the customer and cause satisfaction if fully delivered and dissatisfaction if poorly or not delivered.

Attractive requirements: These requirements are the product criteria which have the greatest influence on how satisfied a customer will be with a given product or service. Attractive criteria or exciting criteria are neither explicitly expressed nor expected by the customer. Fulfilling these requirements leads to more than proportional satisfaction and if they are properly delivered they generate delight. If requirements are not met, however, there is no feeling of dissatisfaction.

According to Sauerwein et al (1996), the advantages of classifying customer requirements by means of the Kano method are very clear:

- Priorities for product development. It is, for example, not very useful to invest in improving must be requirements which are already at a satisfactory level but better to improve one-dimensional or attractive requirements as they have a greater influence on perceived product quality and consequently on the customer's level of satisfaction.
- Product requirements are better understood. The product criteria which have the greatest influence on the customer's satisfaction can be identified. Classifying product requirements into must-be, one-dimensional and attractive dimensions can be used to focus on.
- Discovering and fulfilling attractive requirements creates a wide range of possibilities for differentiation. A product which merely satisfies the must-be and one-dimensional requirements is perceived as average and therefore interchangeable.

Case Study

Customer satisfaction survey

This study consists in a hypothetical customer satisfaction survey. The objective consists in measuring the tourist satisfaction with a travel agency. The criteria considered in this study are: Communication, Responsiveness and Competence. It is not pretended to be an exhaustive or even consistent family of criteria; the objective is uniquely to illustrate the applicability of the method.

A questionnaire was designed to measure the customer satisfaction with the three criteria and also the global satisfaction with the service delivered by the travel agency.

In the context of perceptions of travel agency quality, these quality dimensions are defined as follows:

Communication – the communication criterion refers to the ability of employees to keep customers informed. Good communication implies good listening skills and using language and terms that all customers can understand.

Responsiveness – this criterion relates to willingness that employees exhibit to promptly and efficiently solve customers' problems.

Competence – Competence refers to the employees possessing the required skills and knowledge necessary to perform the service adequately. It measures the employees' ability to perform a job accurately and be able to address customers' questions with the correct answers.

Table 1 -Questionnaire

Communication		Responsiveness		Competence		Global	
Which is your satisfaction level with the communication of the personal of the travel agency X?		Which is your satisfaction level with the responsiveness of the personal of the travel agency X?		Which is your satisfaction level with the competence of the personal of the travel agency X?		Globally which is your satisfaction level with the travel agency service?	
Completely Satisfied (CS)		Completely Satisfied (CS)		Very Satisfied (VS)		Completely Satisfied (CS)	
Very Satisfied (VS)		Very Satisfied (VS)		Satisfied (S)		Very Satisfied (VS)	
Satisfied (S)		Satisfied (S)		Dissatisfied (D)		Satisfied (S)	
Dissatisfied (D)		Dissatisfied (D)				Dissatisfied (D)	
Completely Dissatisfied (CD)		Completely Dissatisfied (CD)				Completely Dissatisfied (CD)	

A five level ordinal scale was used for responsiveness, communication and to the global satisfaction scale and a three level ordinal scale was used for competence. Table 2 presents the survey data corresponding to a total of 30 customers.

Table 2 – Data survey

Customer	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Communication	CD	VS	D	S	D	S	CD	S	S	D	CS	VS	D	D	S
Responsiveness	S	D	VS	S	S	VS	CS	CS	VS	VS	CD	VS	VS	VS	CS
Competence	S	S	VS	S	S	VS	D	VS	S	S	S	D	S	S	D
Global satisfaction	S	VS	VS	S	S	VS	D	CS	VS	D	VS	VS	VS	S	VS
Customer	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*	*29*	*30*
Communication	S	VS	S	S	S	CD	S	S	S	S	S	D	CS	CS	CS
Responsiveness	S	S	VS	S	VS	VS	D	S	D	VS	D	VS	S	S	D
Competence	S	S	S	S	S	S	S	VS	S	S	S	D	S	S	S
Global satisfaction	S	VS	VS	S	S	S	S	VS	S	VS	D	S	VS	VS	S

3. Results

The results for the model parameters obtained from the resolution of Dummy variable regression with constraints are presented in Table 3.

Table 3 - Results obtained from the resolution of Dummy Variable regression with constraints

Communication		**Responsiveness**		**Competence**		**Global Satisfaction**	
Parameter	Numeric Value	Parameter	Numeric Value	Parameter	Numeric Value	Parameter	Numeric Value
a_{11}	-24.10	a_{21}	-48.60	a_{31}	-27.30	g_1	-100.00
a_{12}	-14.00	a_{22}	-38.43	a_{32}	-8.02	g_2	-55.54
a_{13}	-11.92	a_{23}	-34.57			g_3	-55.54
a_{14}	0.00	a_{24}	-27.18			g_4	-45.85

Constraints: $a_{11}+a_{21}+a_{31}= -100$ and $g_1= -100$;
$a_{11}\leq a_{12}\leq a_{13}\leq a_{14}$;
$a_{21}\leq a_{22}\leq a_{23}\leq a_{24}$;
$a_{31}\leq a_{32}$;
$g_1\leq g_2\leq g_3\leq g_4$

With the estimated parameters obtained by dummy variable regression with constraints is possible to compute the utilities, α_{ij}, for all the criteria and global satisfaction scale, γ_l, from the resolution of the matricial system represented in figure 3.

$$\begin{bmatrix} 1 & 0 & 0 & 0 & -1 \\ 0 & 1 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 & -1 \\ 0 & 0 & 0 & 1 & -1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} \alpha_{11} \\ \alpha_{12} \\ \alpha_{13} \\ \alpha_{14} \\ \alpha_{15} \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \\ a_3 \\ a_4 \\ 0 \end{bmatrix} \quad \begin{bmatrix} 1 & 0 & 0 & 0 & -1 \\ 0 & 1 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 & -1 \\ 0 & 0 & 0 & 1 & -1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} \alpha_{21} \\ \alpha_{22} \\ \alpha_{23} \\ \alpha_{24} \\ \alpha_{25} \end{bmatrix} = \begin{bmatrix} a_5 \\ a_6 \\ a_7 \\ a_8 \\ 0 \end{bmatrix} \quad \begin{bmatrix} 1 & 0 & -1 \\ 0 & 1 & -1 \\ 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} \alpha_{31} \\ \alpha_{32} \\ \alpha_{33} \end{bmatrix} = \begin{bmatrix} a_9 \\ a_{10} \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 0 & 0 & 0 & -1 \\ 0 & 1 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 & -1 \\ 0 & 0 & 0 & 1 & -1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} \gamma_1 \\ \gamma_2 \\ \gamma_3 \\ \gamma_4 \\ \gamma_5 \end{bmatrix} = \begin{bmatrix} g_1 \\ g_2 \\ g_3 \\ g_4 \\ 0 \end{bmatrix}$$

Fig. 3 - Matricial system to compute the utilities.

The computed utilities are presented in table 4 for the criteria being evaluated and also for the global satisfaction.

Table 4 – Utilities of the criteria and Global satisfaction

Communication		**Responsiveness**		**Competence**		**Global Satisfaction**	
Variable	Utility	Variable	Utility	Variable	Utility	Variable	Utility
α_{11}	-14.10	α_{21}	-18.84	α_{31}	-15.53	γ_1	-48.61
α_{12}	-4.00	α_{22}	-8.67	α_{32}	3.75	γ_2	-4.15
α_{13}	-1.92	α_{23}	-4.81	α_{33}	11.77	γ_3	-4.15
α_{14}	10.00	α_{24}	2.58			γ_4	5.54
α_{15}	10.00	α_{25}	29.76			γ_5	51.39

Taking into account the ranges of the utilities for each criterion is possible to calculate the relative importance weights of the criteria (table 5).

Table 5 – Criteria weights

	Importance	Weight[(1)]
Communication	24.10	24.10 %
Responsiveness	48.60	48.60 %
Competence	27.30	27.30 %

[(1)] The resolution of the method with the chosen codification and constraints leave to $\mathbf{a}_{11}$, $\mathbf{a}_{21}$ and $\mathbf{a}_{31}$ equal to the importance of the criteria, and consequently the weights.

Table 6 presents the normalized utilities. The normalization procedure is useful when plotting the utility functions to compare the criteria being evaluated. For convenience we used a normalized interval [0,100].

Table 6 - Normalized utilities, α^*_{ij} and γ^*_i

Communication		**Responsiveness**		**Competence**		**Global Satisfaction**	
Variable	Utility	Variable	Utility	Variable	Utility	Variable	Utility
α^*_{11}	0.0	α^*_{21}	0.0	α^*_{31}	0.0	γ^*_1	0.0
α^*_{12}	41.9	α^*_{22}	20.9	α^*_{32}	70.6	γ^*_2	44.5
α^*_{13}	50.5	α^*_{23}	28.9	α^*_{33}	100.0	γ^*_3	44.5
α^*_{14}	100.0	α^*_{24}	44.1			γ^*_4	54.2
α^*_{15}	100.0	α^*_{25}	100.0			γ^*_5	100.0

The utility function numeric values for each criterion are given in figure 4. As can be seen from the figure the relation between levels of satisfaction and utility is not linear. As we can see from the figures the shape of the utility function of the criterion "Competence" indicates that competence is a basic criterion and so a poor performance on these criterion leads to dissatisfaction but an excellent performance does not increase in a significant way the satisfaction of the customer with that criterion. A basic factor is one that is taken for granted. On the other hand the "Responsiveness" is a criterion that increase satisfaction if delivered but do not cause great dissatisfaction if the performance is poor. A high performance in this criterion leads to a big impact in the satisfaction.

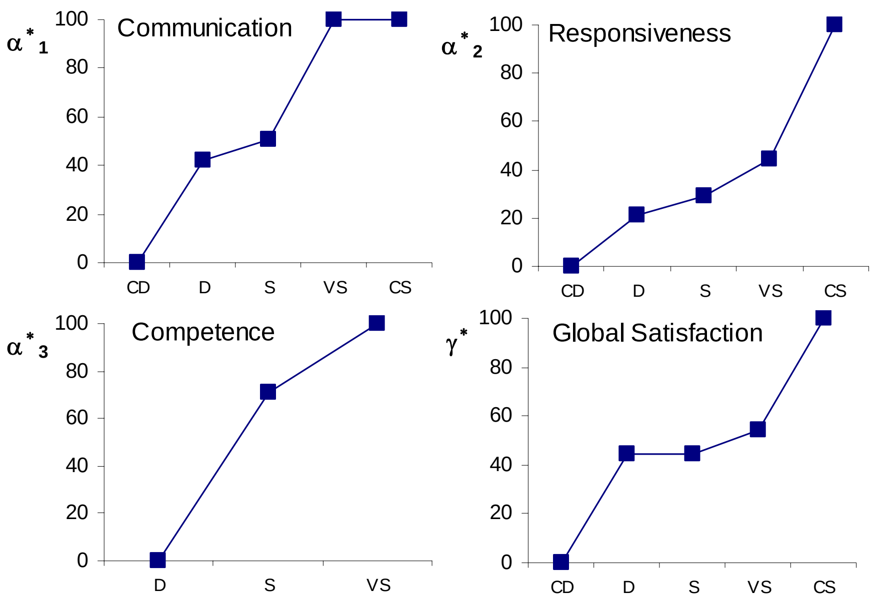

Fig. 4 – Utility functions for the criteria and Global satisfaction

4. Conclusion and Future Research

According to Bussaca (2005) there is the need to develop customer satisfaction programs that properly account for the non-linear response of customer satisfaction to the performance of different product or service criteria if appropriate decisions are to be made for allocating resources to enhance customer satisfaction. The method proposed in this paper permits the estimation of the utility functions of all the criteria, and overall satisfaction with the product or service being evaluated. The estimated utility functions are very important because they show the utility that the customers give to each level of the global satisfaction scale, as well as for the levels of the ordinal scales of each criterion. The results of the work are even more interesting if we consider that whereas the current customer satisfaction programs are still widely based on linear estimates of the relationship between criteria performance and overall satisfaction. Some of the studies employed by practitioners to account for the non-linear and asymmetric response of satisfaction to criteria performance are based on the application of the importance-performance analysis (Martilla et al, 1977, Vavra, 1997, Matzler et al, 2004). The model proposed in this paper follows the principles of regression with Dummy variables with some constraints due to the monotonicity assuming the ordinal nature of the scales used. The implementation of the method in customer satisfaction surveys is very simple and it permits evaluation of the utility that customers attach to the levels of the criteria being evaluated and the construction of utility functions. A great advantage of the method is that it can very simply consider nonmetric data by codification of the criteria levels so in that way is possible to consider the qualitative judgments and preferences of the customer. The method also has the advantage of derive the importance of the criteria when compared to other methods following the stated important approach. The proposed method derives the importance of the criteria and so the survey instrument can be shortened when compared with stated importance approach. The advantages of shortened questionnaires are that it leads to a faster response time and a better response rate (Chu, 2002). In practical consideration the interviews using stated importance measures are longer, more repetitive and tedious as the criteria are usually twice in the importance and performance sections and so the response rate can be seriously undermined.

The proposed method is in development, and it is necessary to assess the reliability and validity of the model. It is also important to analyze the influence of possible outliers and identify the impact on the estimated regression coefficients. The identification of influential cases is an essential step in interpreting the results.

Future research includes comparison of this method with some other alternative methods, as referred in the methodological review, for measurement of customer satisfaction.

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